Not Without My Smartphone! Impacts of Smartphone Addiction on Smartphone Usage

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Abstract
The widespread diffusion of smartphones and their growing importance for private and business use have created new challenges for IS research. This study explores the potential negative effects of smartphone addiction on beliefs and implications for technology use. Using a quantitative survey linking smartphone addiction with technology acceptance, we investigate whether beliefs distorted by addiction, termed maladaptive cognitions, influence usage behavior and thereby potentially lead to smartphone over-use. We thereby assume that addicted users follow their own versions of rationality by acting on distorted beliefs. Based on our PLS-SEM results of 296 responses, we claim that beliefs are positively inflated by smartphone addiction in relation to perceived security, usefulness, and enjoyment, and that these beliefs ultimately bias a person's smartphone usage behavior. Moreover, we discuss the relatively most important role of perceived enjoyment and conclude with implications.

Keywords

Smartphone, addiction, technology addiction, smartphone usage, TAM

INTRODUCTION

The pervasiveness of smartphones and their continuously increasing embeddedness in our lives has been one of the most influential technological developments of the last decade. Smartphones offer increasing connectivity and computing power supporting a range of tasks beyond the basic capabilities of voice calls and short message services (Karlson et al. 2009; Park and Chen 2007). Contemporary studies show that these devices foster the creation of new usage habits making them even more personal and pervasive (Oulasvirta et al. 2012). A central assumption in the dominating literature is that once mastered, these usage effects are positive and offer a multitude of possible benefits (e.g. Mutchler et al. 2011). The current trend of consumerization of technology, exploits these benefits for professional use as employees increasingly use consumer technology at the workplace. In this context, the "Bring your own Device" (BYOD) concept in particular refers to private smartphone use in workplace situations (Loose et al. 2013). While these positive perceptions dominate the IS literature, a more critical appreciation of potential negative effects of smartphone use in particular related to technology addiction and compulsive use is only just emerging (Kwon et al. 2013; Park and Lee 2011).

Technology addiction can be defined as a mental health condition characterized by a maladaptive dependency on the use of technology (Turel et al. 2011). This kind of addiction may lead to a wide range of adverse effects including technology over-use and increasing usage tolerances, personal withdrawal, conflicts with other activities or tasks and mood changes. Smartphone over-use may cause sleep disorders, problems with concentration and physical pain, especially in the neck and wrist, and negatively influence the work-life balance by blurring boundaries between work and private life (Kwon et al. 2013). Technology addiction is a relatively new concept in IS, previously considered in the contexts of the Internet (Armstrong et al. 2000; Young and de Abreu 2011), online and offline gaming (Mehroof and Griffiths 2010; Ng and Wiemer-Hastings 2005), online auctions sites (Turel et al. 2011), and mobile devices (Turel and Serenko 2010; Turel et al. 2008). Most current studies in the context of smartphones, however, are limited to the symptoms and consequences, and lack a deeper understanding of the usage component placed into existing technology acceptance theory (Turel et al. 2011). Moreover, if, why, and when addiction affects smartphone acceptance still largely remains a black box.

This study bridges this gap and aims at identifying and exploring relationships between smartphone addiction and smartphone use via the logics of biased reasoning. More specifically, we seek to investigate whether addiction indeed leads to distorted beliefs typically considered in related technology acceptance studies, which in turn should generate inflated behavioral usage intentions preceding actual smartphone usage. Consistent with

behavioral addiction models, our overall findings show that users' levels of smartphone addiction alter beliefs and attitudes toward the artifact, which relate to perceived security, perceived enjoyment, perceived usefulness, but not perceived ease of use. Moreover, we also show for the context of smartphones that perceived enjoyment and not perceived security influences reasoned smartphone usage decisions. Central is perceived enjoyment, which is most strongly distorted by smartphone addiction while at the same time most strongly affects smartphone acceptance via perceived ease of use. We also outline implications for research and practice.

To address these issues, we designed a quantitative survey and conducted a partial least squares structural equation modeling (PLS-SEM) analysis of the 296 responses to validate the measurement model and test hypotheses. Our study relates to Austria where we see a rising smartphone general penetration rate of 48%, and 85% for the age group of 18-24 years in 2013 (Ipsos MediaCT et al. 2014). Whilst this study will be of most significance to developed countries in the European Union, it is likely that they apply to other regions as well, as increased smartphone penetration and addiction are seen as global phenomena.

RESEARCH BACKGROUND AND MODEL

Technology Addiction

Technology addiction is a type of nonchemical addiction, and hence a behavioral phenomenon. Although behavioral addiction lacks the necessity of physical consumption of substances, it exhibits similar symptoms, consequences and even treatment as substance addiction (Grant et al. 2010). By contrast, it has been argued that technology addiction is not an addiction as such, but rather pathological use (Armstrong et al. 2000; Davis 2001; Griffiths 2000). Definitions of technology addiction include active and passive forms of "nonchemical (behavioral) addictions that involve human-machine interaction" (Griffiths 2000, p. 211). Technology addiction was also defined as "a psychological state of maladaptive dependency on the use of a technology to such a degree that … typical behavioral addiction symptoms arise" (Turel et al. 2011, p. 1044). These symptoms, such as increased salience, withdrawal or tolerance, are often accompanied by biased reasoning and distorted perceptions and beliefs (Turel et al. 2011), which are largely unexplored for smartphone addiction in IS studies.

While the importance and use of the smartphone as ubiquitous device are constantly growing (Ballagas et al. 2006; PewResearch 2014), research on smartphone addiction or pathological use is only emerging and sparse. Smartphones extend mobile phones by smart functionalities, sensing, localization and interaction with the environment (e.g. cameras) or by software (Apps) (Ballagas et al. 2006). So far, studies on smartphone usage are mainly connected to mobile service (Hong and Tam 2006; López-Nicolás et al. 2008; Nysveen 2005) and m-commerce (Kim et al. 2010; Wu and Wang 2005). Some first insights into smartphone addiction are emerging, which include a "Mobile Phone Problem Usage Scale" to predict problematic mobile phone use (Bianchi and Phillips 2005) and a Smartphone Addiction Scale (Kwon et al. 2013). Addiction on artifacts such as smartphones (Turel et al. 2008) and mobile communication (Turel and Serenko 2010) demonstrate that excessive use may influence the life and the perception of the technology (Turel et al. 2008). Reasons for smartphone addiction may include rush, excitement, fulfilment of compulsive gambling, shopping and other (Turel and Serenko 2010).

Consistent with our main reference study, we define smartphone addiction as "the maladaptive psychological dependency on the use of smartphones to such a degree that typical behavioral addiction symptoms occur" (Turel et al. 2011, p. 1046). Although the field of IS has developed from a consolidation of work to understand user satisfaction and IS acceptance (Córdoba et al. 2012), the impact of technology addiction has not yet been integrated into mainstream IT use models (Turel et al. 2011). It is therefore crucial to understand if smartphones which are becoming a pervasive component of everyday lives may cause adverse usage consequences.

Research Model

Based on the presented theoretical foundation, we suggest that smartphone addiction influences beliefs and subsequently affects usage of smartphones. The research model (Figure 1) includes a behavioral addiction model adapted to the smartphone context. It posits the emergence of distorted beliefs as a possible result of addiction (H1a-d) which eventually lead to increased levels of intention to use and actual usage of smartphones (H3a-d). Moreover, we also posit that perceived enjoyment positively affects perceived ease of use and security levels positively affect perceived usefulness (H2a-b). Theoretically, we therefore incorporated the well-established technology acceptance model (TAM) to link smartphone addiction with smartphone acceptance in a reason-based process model. In accordance with a related study on online auctions, our central assumption therefore is that addiction to technology may distort behavioral usage intentions and actual usage (Turel et al. 2011). More specifically, the level of smartphone addiction distorts the way the artifact is perceived (distorted beliefs) and subsequently used via inflated behavioral usage intentions. We therefore investigate the phenomenon of pathological smartphone use (Armstrong et al. 2000; Davis 2001; Griffiths 2000).

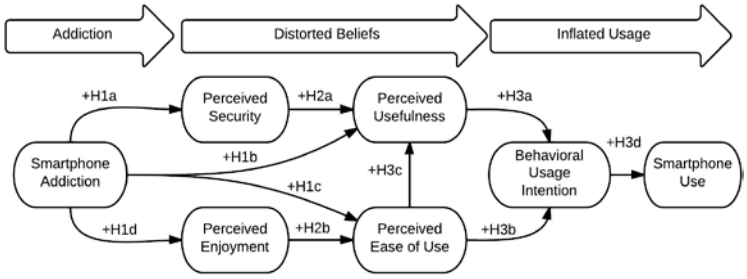

Figure 1: Research Model

Research Hypotheses

Addiction influences the thoughts and perceptions of addicts (Huh and Bowman 2008; Turel et al. 2011). Addicts seek the artifact or substance they are addicted to and hence overrate positive effects, such as perceived usefulness, perceived ease of use, perceived enjoyment (Robinson and Berridge 2001), and underrate negative effects, such as security vulnerabilities (Huh and Bowman 2008), leading to maladaptive cognitions (Davis 2001). Therefore, excessive use influences "the way he or she perceives the technology" (Turel et al. 2008, p. 10). Based on the literature on technology addiction, smartphones may generate a "framing effect" leading to a more positive perception of the artifact (Turel et al. 2011). We now shortly develop these effects more specifically in terms of influencing certain perceptions (perceived usefulness, perceived ease of use, perceived enjoyment, and perceived security) and where possible, relate specifically to the smartphone context.

Firstly, we consider the effects of addiction on perceived levels of smartphone security, which is becoming increasingly important due to a growing popularity of smartphones and their Apps marketplaces (Leavitt 2011). These devices potentially store sensitive or classified information, such as passwords or personal data, which can be misused and exploited by an attacker (Uffen et al. 2013). Smartphones can be stolen or compromised by targeting known vulnerabilities leading to data loss or theft (Leavitt 2011). These security concerns are of particular importance for the success of mobile commerce (Wu and Wang 2005) as well as in the context of BYOD and business information (Loose et al. 2013; Markelj and Bernik 2012). Smartphone addicts, however, may disregard or overlook smartphone risks (Bianchi and Phillips 2005). We therefore assume that smartphone addiction may lead to the false belief of increased security, neutralizing concerns about vulnerabilities and related risks (Bauer and Bernroider 2014). Accordingly, we hypothesize:

H1a : Smartphone addiction (SA) has a positive effect on Perceived Security (PS).

The mentioned "framing effect" should in particular apply to the two central beliefs of the Technology Acceptance Model (Davis 1989), which are known to predict technology usage. We therefore also posit that the level of addiction influences perception of usefulness and ease of use:

H1b : Smartphone addiction (SA) has a positive effect on Perceived Usefulness (PU).
H1c : Smartphone addiction (SA) has a positive effect on Perceived Ease of Use (PEOU).

Finally, we considered perceived enjoyment, which is an intrinsic motivation for information system usage (Davis et al. 1992). It has been demonstrated that perceived enjoyment influences behavioral usage intentions (Davis et al. 1992). Rush, excitement and sensation seeking (Armstrong et al. 2000) have been evidenced to influence heavy usage related to technology addiction. In accordance with the above mentioned tendency of addicts to overestimate positive effects (Robinson and Berridge 2001), we assume:

H1d : Smartphone addiction (SA) has a positive effect on Perceived Enjoyment (PE).

Perceived security was reported to be important in many studies, e.g, in the context of online banking (Lee 2009) and online purchase intention (Salisbury et al. 2001). Prior work addressing mobile security was mostly concerned security of Apps and their platforms (López-Nicolás et al. 2008). An effect of perceived security on behavioral usage intention has been shown in the mobile context, especially concerning mobile payment (Kim et al. 2010) and mobile wallets (Shin 2009). Recent studies, however, have shown that awareness for mobile security is very low (Harris et al. 2013; Mylonas et al. 2013). Furthermore, mobile communication makes the device more vulnerable to identity and data theft (Leavitt 2011), but a compromised smartphone is not useful anymore. Hence, we hypothesize:

H2a : Perceived Security (PS) positively influences Perceived Usefulness (PU).

Studies have shown that perceived enjoyment effects behavioral usage intentions (Davis et al. 1992; Heijden 2004). A positive interaction between perceived ease of use and perceived enjoyment has been indicated especially in hedonic information systems (Heijden 2004). In the context of mobile devices, the effects of

perceived enjoyment on behavioral usage intention are discussed diversely. Some studies evidenced a positive relationship of enjoyment on adoption intention (Chun et al. 2012) or smartphone behavioral usage intention (Chun et al. 2012; Park and Lee 2011), others found effects of perceived enjoyment on perceived ease of use, perceived usefulness and behavioral intention supported (Hong and Tam 2006). This relationship has already been demonstrated in the technology acceptance context, stating that perceived enjoyment positively influences perceived ease of use (Venkatesh and Bala 2008). We follow this argumentation and hypothesize:

H2b : Perceived Enjoyment (PE) positively influences Perceived Ease of Use (PEOU).

To explain usage intention and actual usage, our research model adapts the Technology Acceptance Model (TAM) (Davis 1989), which is a highly influential model on usefulness and acceptance of IS (Córdoba et al. 2012). It has been further developed and refined by different studies (e.g. Venkatesh and Bala 2008; Venkatesh et al. 2003) and has been largely confirmed in a wide range of technology applications including online and mobile services (Lee 2009; López-Nicolás et al. 2008). One of the few works on technology addiction has used TAM to investigate how technology addiction distorts beliefs and behavioral usage intentions (Turel et al. 2011). For our study, we chose a consistent approach and suggest that the extent of the actual use of a smartphone for more than taking a phone call (actual use) is influenced by the strength of one's intention to use the smartphone (behavioral intention), depending on the degree to which users believe that a smartphone would enhance their task performance (perceived usefulness) and the degree to which users believe that using it would be free of effort (perceived ease of use). Moreover, perceived ease of use has an influence on perceived usefulness and both are affected by external variables. Consequently, we summarize the application of TAM as follows:

H3a : Perceived Usefulness (PU) positively influences Behavioral Usage Intention (BUI)
H3b : Perceived Ease of Use (PEOU) positively influences Behavioral Usage Intention (BUI)
H3c : Perceived Ease of Use (PEOU) positively influences Perceived Usefulness (PU)
H3d : Behavioral Usage Intention (BUI) positively influences Actual Use (USE)

METHODOLOGICAL APPROACH

Based on the research model and hypotheses, we designed the research instrument for a quantitative survey. We targeted all students studying at WU Vienna (Austria) and consider them as appropriate test subjects due to the following reasons. First, students are among the most active smartphone users, matching the age groups most penetrated by smartphones in Austria (85% for 18-24 years and 70% for 25-34 years) (Ipsos MediaCT et al. 2014). Second, students use smartphones for private purposes and professional tasks, making them ideal subjects for considering smartphone use under the IT consumerization context. Finally, related research has shown that responses from student subjects are more homogeneous than their nonstudent counterparts in general terms (Peterson 1994), and that reliability did not differ when comparing student and non-student samples with regard to reliability coefficients for scores of the TAM variables used in our model (Hess et al. 2014). Hence, our results should be generalizable to some extent to young and educated populations in developed economies.

The measurement items were assessed by local users and the co-authors for content validity and adapted to the context of smartphone usage. Three rounds of pre-testing including eight pre-tests were conducted with students and research assistants, which resulted in further revisions. We applied a Web-based online instrument without implementing any incentives. After the anonymous data were obtained, we screened for possible aberrant response behavior, such as random responding. Further tests accounted for nonresponse bias analysis via the commonly applied wave analysis and common method variance (CMV) (Podsakoff et al. 2003).

We applied PLS-SEM as it makes no assumptions about the data and supports predictive and exploratory purposes (Hair et al. 2013). We used the software package SmartPLS (Ringle et al. 2005) and SPSS (version 20) for further statistics. For measuring technology acceptance dimensions, we used MIS instruments with well-established psychometric properties, which we carefully adapted to the smartphone context where necessary (Davis 1989; Gefen et al. 2003; Johnston and Warkentin 2010; Nysveen 2005). For assessing smartphone addiction, we adapted an uni-dimensional construct of online game addiction (Charlton 2002), which was also recently used in an addiction study on online auctions (Turel et al. 2011). This uni-dimensional scale captures addiction symptoms emphasizing salience and conflict. Finally, we captured perceived security (Ha and Stoel 2009; Kim et al. 2010) and perceived enjoyment (Davis et al. 1992; Heijden 2004) by combining IS studies which considered these dimensions (instrument available on request).

RESULTS

We received 310 full and 76 partial responses after inviting all students registered at WU Vienna to assess the online questionnaire by Email. After eliminating the partial data sets and 14 invalid full responses, we retained 296 usable data sets for data analysis. The sample represents mainly young students already owning smartphones

for several years (Table 1). To examine the possibility of bias, we investigated survey nonresponse bias via wave analysis, where early versus late respondents are compared on the assumption that late respondents more likely resemble non-respondents (Moore and Tarnai 2002). We therefore divided the sample into two groups based on the time the response was registered. We classified early respondents as those who responded within the first 24 hours of extending the email invitation (N=213), and responses thereafter as late (N=83). The groups revealed no differences in terms of occupation (χ^2 test, p=.243) and years of smartphone ownership (two-sample unpaired t tests, p=.406). However, in terms of gender (χ^2 test, p=.02) and age (two-sample unpaired t tests, p=.02), differences between were detected. The differences between the means are low and do not suggest problematic levels of bias. Late respondents have an average age of 23.7 years and are represented by 67.5% female students. We conclude that our target sample is slightly biased in terms of under-representing younger female users. To account for the mono method research design we used a Harman's single-factor test as a diagnostic method to test for common method variance (CMV). Thereby we entered all constructs into a principal components factor analysis to see if either a single or general factor emerges that may cause the majority of covariance among measures (Podsakoff et al. 2003). Fourteen factors emerged. The first accounts for 16.6% of the variance. The other thirteen (with eigenvalues > 1) contribute to the remaining 49.8% of the variance explained by the set, each for 1.9% to 8.4%. This suggests that while there is likely to be some CMV, the effect is relatively small.

Table 1. Basic Demographics of the Survey Sample (N=296)

Female	56.7%	Full-time	45.5%
Male	43.3%	Part-time	52.4%
		Retired	2.1%
Age (mean)	25.0 years	Smartphone ownership (mean)	3.5 years

Test of the Measurement Model

The assessment of our reflectively measurement model included testing for internal consistency reliability, convergent and discriminant validity, and indicator reliability (Hair et al. 2013; Ringle et al. 2012). Composite reliability was used to test internal consistency reliability of constructs (see Table 2).

Table 2. Measurement Model Validity and Reliability

Latent Construct	Comp. Rel.	AVE	SA	PS	PE	PEOU	PU	BUI	USE
Smartphone Addiction (SA)	.87	.57	**.75**						
Perceived Security (PS)	.95	.78	*.20*	**.88**					
Perceived Enjoyment (PE)	.92	.71	*.39*	*.25*	**.84**				
Perceived Ease of Use (PEOU)	.92	.65	*.07*	*.28*	*.37*	**.81**			
Perceived Usefulness (PU)	.93	.69	*.26*	*.16*	*.48*	*.29*	**.83**		
Behavioral Usage Int. (BUI)	.95	.87	*.20*	*.05*	*.23*	*.20*	*.27*	**.93**	
Smartphone Use (USE)	.89	.81	*.35*	*.12*	*.41*	*.23*	*.52*	*.53*	**.90**

Composite reliability values above .708 are considered acceptable (Nunnally and Bernstein 1994). All the composite reliability values demonstrate that the seven constructs have high levels of internal consistency. Convergent validity is confirmed for all constructs as the values of Average Variance Extracted (AVE) are all above the required minimum level (>.5). The Fornell-Larcker criterion and the cross-loadings allowed for testing discriminant validity. Referring to Fornell-Larcker, the square root of the AVE of each construct should be greater than its correlation with other latent variables, which applies to our data. Hence, the items measuring the construct are more closely associated with its intended construct than with any other, which supports discriminant validity (Fornell and Larcker 1981). In addition, the squared root of the AVE by a construct from its indicators should be at least 0.7 and an AVE of more than 0.5 means that 50% or more variance of the indicators is accounted for. Both criteria are met by our sample. Further adding to construct validity is the consideration of indicator reliability. Standardized item loadings should be greater than 0.7 and items should load more highly on their intended construct than on other constructs. Discriminant validity is also established when an indicator's loading on a construct is higher than all of its cross loadings with other constructs. Each indicator has the highest value for the loading with its own construct, while cross loadings with other constructs are considerably lower. Hence, the validation results suggest that these constructs demonstrate satisfactory reliability and construct validity.

Test of the Structural Model

The purpose of the SEM was to test our three sets of research hypotheses with the intention to explore the effects of smartphone addiction on smartphone use and the roles of perceived enjoyment and perceived security. Figure 2 shows the standardized path coefficients and significance levels, and also includes the amount of variances explained (R^2) and predictive relevance (Q^2) (Geisser 1974). We used the results from bootstrapping with 1,000 subsamples as a non-parametric re-sampling procedure to calculate t-statistics and standard errors (Chin 1998).

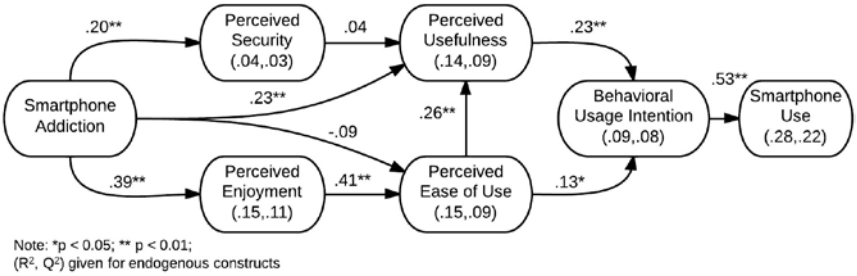

Figure 2: PLS-SEM results

For each effect in the structural model different effect sizes based on R^2 were evaluated (Cohen 1988). It was suggested that effect sizes of .02, .15, and .35 mean small, medium, and large effects, respectively. The level of smartphone addiction has a small positive effect (β=.20, p<.01) on perceived smartphone security levels and also a small direct positive effect (β=.23, p<.01) on the smartphone's perceived usefulness, supporting hypotheses 1a-b. However, addiction levels do not impact perceived ease of use, hence not supporting hypothesis 1c. Medium effects of addiction were seen on perceived enjoyment (β=.39, p<.01), thereby supporting hypothesis 1d. About 15% of the variance of perceived enjoyment is explained by addiction. Secondly, in terms of our mediators, perceived security has no effects on perceived usefulness, thereby not supporting hypothesis 2a, while perceived enjoyment has medium effects on perceived ease of use (β=.41, p<.01), supporting hypothesis 2b. Approximately 14% of the variance was explained for perceived usefulness, while about 15% of the variance for perceived ease of use was accounted for by the model. Thirdly, the TAM model was confirmed with regard to all hypotheses 3a-d. Perceived ease of use has small effects on perceived usefulness (β=.26, p<.01) and small effects on the behavioral intention to use the smartphone (β=.13, p<.05), which is also affected by perceived usefulness (small effects, β=.23, p<.01). Finally, behavioral intention has large effects on smartphone use (β=.53, p<.01). Approximately 28% of the variance is explained for actual use and 9% for behavioral usage intention.

DISCUSSION

This research investigates the relationships between smartphone addiction and smartphone use via biased reasoning, which has been evidenced by prior research, stemming from psychology and mental health, but also from MIS research. Since research on smartphone addiction is rare, we based our research on existing works from technology addiction, which has indicated that addiction modifies and distorts perceptions of addicts towards the artifact. MIS research suggests that beliefs attributed to technology (i.e. usefulness, ease of use, security, enjoyment) influence behavioral usage intention and finally actual usage. Thus, it can be assumed that addiction to an artifact, such as smartphones, distorts beliefs influencing usage and acceptance by addicts. Data collected from 296 students via an online survey support these assumptions. However, some have not been confirmed. Our results provide new insights into underlying concepts of technology addiction and offer starting points to prevent negative effects of technology addiction. Hence, this research on the effects of smartphone addiction on smartphone usage clearly has significant theoretical as well as practical implications.

Theoretical Implications

Our results support some interesting implications, namely the predominant influence of enjoyment. Concerning the degree of smartphone addiction, the positive effect evidenced on perceived enjoyment is higher, compared to the effect on perceived usefulness and perceived security. However, positive effects on perceived ease of use have not been confirmed. This is in accordance with considerations by prior research, which also suggested that the relationship between addiction and perceived ease of use may be weak (Turel et al. 2011). We follow the argumentation that constant usage may lead to increased smartphone self-efficacy, decreasing at the same time the importance of ease of use (Turel et al. 2011). This is again in line with our findings on ease of use having small effects on behavioral usage intention. Concerning perceived security, we cannot confirm any effects of perceived security on perceived usefulness in the smartphone context, which contradicts findings in different IS contexts (Leavitt 2011). Security awareness seems to be perceived as less of an issue in the mobile context (Mylonas et al. 2013). Not surprisingly, the TAM based hypotheses were all confirmed. The most important variable is perceived enjoyment, being influenced by the degree of addiction and influencing perceived ease of use. As addiction increases the feeling of "having fun", the smartphone is perceived to be more useful and secure. Moreover, perceived enjoyment even influences ease of use, which is not effected directly by addiction. This result is consistent prior research on addiction and mental conditions of addictions, such as sensation-seeking and mood changes (Mehroof and Griffiths 2010; Young and de Abreu 2011). Since research on technology addiction is in its infancy, only some studies have tested the influence of addiction on actual usage in connection with other technological artifacts (Turel et al. 2011). Prior research suggests that addiction distorts

perceptions. We have also identified these so-called maladaptive cognitions in the context of smartphone addiction. These findings and the important role of perceived enjoyment are the main contribution of this work. We suggest to extend existing IS theory related to IS acceptance and usage models and incorporate the possibility of biased perceptions and technology over-use in particular in the context of consumer technologies.

Practical Implications

In the last years the social impacts of IT received great attention and have been addressed from various perspectives, among them technology addiction. Also political organizations, such as the EU, increased their efforts in understanding these negative impacts (University of Siegen 2010). Negative impacts from behavioral addiction – including smartphone addiction – may, for example, arise in form of changes in the societal structures due to social isolation of addicts (Mehroof and Griffiths 2010) or causing problems in the job (Turel et al. 2011) which may lead to financial problems. Since similarities with gambling addiction exist, measures to prevent from negative impacts can be adopted from this area. This could include the implementation of a responsible smartphone usage agenda in accordance with the concept of responsible gaming. Moreover, some countries developed binding laws for gaming providers, which have to be met to receive permission to operate (Kelley 2000). This could also be a way to control smartphone addiction by developing appropriate measures for self-control, such as warnings based on time using the smartphone. In the context of the increasing use of private smartphones to access company networks (BYOD), our results are of particular importance. We reported that addicted smartphone users have inflated beliefs about the security of their phones. However, while this finding seems worrisome, it does not matter much when it comes to smartphone acceptance as perceived security was not identified as a predictor of perceived usefulness. It seems that in accordance with previous studies (Harris et al. 2013), our target population, lacks security awareness. Awareness building and the appreciation of security measures have not yet caught up with the popularity of mobile devices despite increasing efforts to secure Apps and their platforms (López-Nicolás et al. 2008). For any IT governance strategy (Novotny et al. 2012) that seeks to include smartphones it seems essential to consider potential smartphone addiction and adequate security awareness training (Bauer and Bernroider 2013).

Limitations and Future Work

We acknowledge some central limitations of this quantitative study. First, the conceptualization of technology addiction in particular in the context of mobile technology is at an early stage of research. Future work should aim at clarifying technology addiction and synthesizing related theory to provide more support for application specific surveys. Second, common problems in empirical quantitative research are reliability and external validity. While we detected low levels of possible bias towards under-representing young female students, we may have missed additional concerns of non-response bias based on response waves. We could not avoid the use of a mono method for the survey, which however is common in many studies of similar designs. We did however extensively apply pre-tests, test for common method variance and control for the target persons for the study. Also, our latent-variable structuring approach required multiple operationalizations of each construct seen to be more reliable than single-indicator measurements (Baron and Kenny 1986). Future research could extend this study to different populations or test the effect of addiction in the context of continued IT usage models, which become more important as users move into the post-adoption stage.

CONCLUSIONS

Technology addiction and its effects on individual belief systems and implications in terms of possibly inflated and abusive technology use are relatively new topics for IS research. Taking the increasing penetration of mobile technologies into consideration, in particular related to smartphones, these topics become even more important. In this quantitative study, smartphone addiction has been integrated into a behavioral model incorporating smartphone addiction as the independent variable, which possibly influences beliefs and eventually smartphone usage, which was conceptualized with the common technology acceptance model (TAM). We therefore posit that users follow reason and by doing so are rational when deciding on smartphone usage. Their reasons, however, may be based on inflated or distorted beliefs about the subjective utility of the smartphone technology.

The empirical findings clearly suggest that smartphone addiction levels inflate beliefs about the utility of the technology with regard to the levels of perceived security, perceived enjoyment and perceived usefulness, while not impacting perceived ease of use. Perceived enjoyment is not only influenced most by smartphone addiction, but also the most important factor impacting subsequent smartphone acceptance. However, regardless of addiction levels, users do not account for perceived security when deciding on smartphone usage. Relating to TAM, perceived usefulness is relatively more important than perceived ease of use in terms of being explained by technology addiction and also for explaining behavioral usage intentions. Given the increased penetration of

mobile technologies, IS research and theories should put effort into research to better differentiate between effective and non-effective levels of technology use and acceptance for the ultimate benefit of our societies.

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